Mini-DST and Sampling Instead of HPHT Well Test, North Sea

Formation testing with MDT tester collects fluid and confirms low permeability in deviated HPHT well

CHALLENGE
Conduct mini-DST and fluid sampling to characterize a very low permeability formation in a North Sea deviated HPHT well.

SOLUTION
Deploy MDT* modular formation dynamics tester with the Dual-Packer Module (MRPA) to effectively isolate a large interval of the borehole for fluid sampling and to conduct a mini-DST.

RESULTS
Confirmed the very low permeability of the formation, with no fracture permeability, and obtained formation fluid samples without abnormal tension during logging or conveyance in this challenging environment.

Formation testing in a challenging environment
Talisman Energy Norge AS’s formation testing program called for formation pressure measurements and sampling in a deviated HPHT well in North Sea. In addition to the challenging well environment, logging with the CMR-Plus* combinable magnetic resonance tool indicated that the formation had very low permeability, which would further complicate both testing and obtaining formation fluid samples. Another concern was the likelihood of differential sticking because of the high overbalance in the well. If the formation testing operation was not successful, an expensive well test would be necessary.

Expanding the isolated interval
Using the Dual-Packer Module fitted with high-performance packers expands the operating envelope for formation testing and sampling with the MDT tester to a temperature rating of 350 degF [177 degC]. The dual packers effectively isolate a large area of the formation, with a 3.2-ft [0.98-m] interval between the packers that can be extended up to 11.2 ft [3.4 m]. The 3.2-ft interval of the borehole is about 3,000 times larger than the area isolated by a single-probe module. In low-permeability formations, using the MDT tester configured with the Dual-Packer Module enables fluid withdrawal with only a minimum pressure drop through the larger flowing area. Phase separation is avoided because of the larger flowing area minimizes pressure drop.

Reliably evaluating reservoir properties
Using the TLC* tough logging conditions system for conveyance because of the high overbalance, the MDT tester was deployed and retrieved without any abnormal tension readings. Operational reliability was further enhanced by the autoretract mechanism (ARM) of the Dual-Packer Module, which applies a longitudinal tensile force to assist in retracting the packers after deflation.

Three mini-DST stations were attempted. The first collected high-quality data and representative formation fluid samples. Two 450-cm³ bottles and a 1-gal US single-phase sample were recovered. Although the other two station tests were successfully performed despite the extremely high differential pressure across the packers, they did not fully stabilize because of the very low permeability. The absence of any fracture permeability was also confirmed.

| Three Mini-DST Stations Performed in HPHT Conditions During a Single Run of the MDT Tester |
|----------------------------------------|--------------|----------------|------------------|
| Station | Hydrostatic Pressure, psi | Max. Differential Pressure, psi | Max. Temperature, degF [degC] |
| 1       | 9,851                     | 3,264          | 331 [166]        |
| 2       | 9,769                     | 2,940          | 333 [167]        |
| 3       | 9,919                     | 3,946          | 334 [168]        |

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